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Construction of the Payoff Matrix for the Loyalty Program Model

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Abstract. An approach to creating a payoff matrix for modeling using the game theory to find the optimal strategies of the seller and the buyer is proposed. The index of customer loyalty can be used as input data. The result is a payoff matrix consisting of forecasted average profits.

INTRODUCTION

The successful application of operations research methods [1], [2], [3], in business depends on the correct formulation of the problem and some unique idea which allows to construct the mathematical model [4]. Loyalty programs for transport companies, for example, S7 Priority, Aeroflot Bonus Program, RZD BONUS loyalty program, have specific features compared to customer loyalty in another business service sector. Their customers usually do not change their preferences. Therefore, carriers should first of all try to keep their regular customers and secondarily think about attracting new customers.

Currently, a passenger usually has membership in several loyalty programs. And when he books a ticket, which in the conditions of competition have approximately the same cost, he will turn his attention to additional preferences purchased for the accumulated bonuses.

What additional services of a transport company can interest their client? And we are talking about free bonus services. Such additional services are taxi, VIP lounge, business class, car rental, discount at the hotel, etc. In addition, the client may benefit from cashback points for paid services, which he can then spend on a future service. To compensate for such unprofitable offers, the transport company must be sure that its costs will pay off.

The loyalty program is an investment project [5]. Often this is a long–term investment and transport company needs a well–defined management strategy. Added to this is the uncertainty in customer behavior. To model a loyalty program using game theory, an algorithm for creating a payment matrix is needed.

PAYOFF MATRIX AND THE GAME THEORY

Keeping customers loyal is marketing and yet companies often spend much less on customer retention than customer acquisition. Forrester research found in 2016 that B2C marketers devoted 37% of their budget to attracting new customers and only 20% of their budget to retaining existing clients. This is despite research that shows that customer retention can pay off between 25% and 125% annually. But it's easier to retain than to find new. It is known that 20% of loyal customers provide 80% of the company's profit.

The Game Theory principles application to the formulation of business and marketing strategy would be worthwhile. Neumann and Morgenstern in their book "Theory of Games and Economic Behaviour" [6] identified two types of games. The first is rule-based games where players interact according to specified rules of engagement. In the second type players interact without any external constraints. Business is a complex of both types of games.

In the Table 1 [8], the main possible strategies for the actions of loyalty program managers and the likely consumer strategies with the corresponding company profits are written out.

The question arises: how to calculate or evaluate the values of profits?

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TABLE 1. Net profit of an entrepreneur, RUB.

	Spend bonuses	Save bonuses	Recommend	Earn bonuses out	Not active
VIP Promotion	33000	25000	36000	47000	26000
Customer retention	28000	21000	30000	48000	29000
Sale to customers	34000	35000	29000	27000	31000
Brand attractiveness	26000	27000	32000	28000	27000

COHORT ANALYSIS

Cohort analysis in loalty program is a subset of behavioral analytics and it breaks customers into related groups. These groups (cohorts) usually share common characteristics or experiences within a defined time–span. Cohort analysis allows a company to see patterns clearly across the life–cycle of a customer. By seeing these patterns of time, a company can adapt service to those specific cohorts. Cohort analysis is specifically the analysis of cohorts in regards to big data and business analytics [7].

The following indicators are used:

- Participation rate – the ratio of the number of program participants to the total number of clients
- Activity rate – percentage of participants actively participating in the program
- Duration (Tenure) – duration of participation in the program
- Inactivity Period – the time interval that has passed since the last activity of the participant in the program. It is usually 12 – 18 months.
- Churn rate – the ratio of the number of participants who left the program to the total number of participants. Outflow is recorded if the period of inactivity exceeds a threshold value.
- Redemption rate – the ratio of redeemed and accrued bonus units at a particular point in time.
- Combustion rate (Breaking rate) – the percentage of bonus units that will be written off in connection with the expiration of validity and other rules that exist in the program.
- Average reward price – the average reward price per bonus unit accepted in the program.
- The average cost of a bonus unit (Cost–per–point) – the value of the bonus unit of the program in monetary terms.
- Average member spending per transaction – the average amount of bonus units repaid per transaction.
- The program cost coefficient (Loyalty program percentage cost) – the ratio of the total cost of bonus units accrued to participants to the total income generated by program participants.
- Program Value Added (Loyalty Uplift) – a measure of the added value of a loyalty program for a company. As a rule, the value of the program is reduced to financial indicators.

COMPANY'S PROFIT DEPENDENCE ON IMPLEMENT STRATEGIES

The projected earnings of the company are calculated based on the results of a cohort analysis. When implementing each pair of strategies, profit is made up of the following factors: the dynamics of the average cost of transportation, the average level of repeated calls to the company are monitored, the impact of loyalty on the increase in the total number of customers is assessed, the rate of profit per client grows when the loyalty effect occurs.

To calculate the customer loyalty index for i-th transport company the following formula is used

$$L_i = 100 \sqrt[3]{b_i \frac{(r+1)-s_i}{m} \frac{(n+1)-p_i}{n}},$$

where

b_i – the share of the budget allocated to transport and additional services;

s_i – the number of "switchings" of the consumer between transport companies for a certain period of time;

p_i – the number of transport companies in which consumer purchased goods of this category during the survey;

m – the total number of shipments for a certain period;

$k = m - 1$ – the number of opportunities for "switching" between transport companies;

n – the number of modes of transport available to the consumer for a specific period of time.

Then the profit of the company per loyal customer is equal to

$$P_i = C_i L_i ,$$

where C_i is a average cost. Multiplying P_i by the number of loyal customers one can find a profit. Then it is necessary to group customers according to their expected decisions (strategies). The following gradations were proposed in [8]: "Spend bonuses", "Save bonuses", "Recommend", "Earn bonuses out" and "Not active". Based on possible strategies of the seller: "VIP Promotion", "Customer retention", "Sale to customers", and "Brand attractiveness", a payment matrix is formed with elements corresponding to expected profits. Then one can model using game theory [9] .

CONCLUSION

An approach to creating a payoff matrix for the subsequent simulation of a loyalty program using game theory is described. Moreover, modeling can be carried out as a game with nature or a game of two players.

Customer analytics play a key role in helping organizations optimize and support key junctures throughout the entire customer journey where the goal is to ensure that whatever type of interaction or channel used, the customer receives a consistent, personalized and compelling experience. When one customer experience after another is positive, loyalty is follow.

It should be noted that the loyalty program for transport companies has features. Consumers of transport services and passengers do not often change their preferences. But on the other hand, loyal customers are interested in improving their status in order to have improved service.

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